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DEPARTMENT OF GEOGRAPHY

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PERMAFROST IN SOUTHERN

LABRADOR-UNGAVA

by

J. T. Andrews

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It may be modified in its final published form.

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of

ESTHER

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PERMAFROST IN SOUTHERN LABRADOR-UNGAVA

J. T. ANDREWS*

A new map of permafrost in Canada has been published recently based on actual observations, rather than on theoretical grounds (Brown 1960). In Labrador-Ungava the approximate southern limit of discontinuous permafrost passes through Schefferville and along the 55th parallel. As the southern boundary is drawn from site reports of permafrost, the accuracy of the map is proportional to engineering and mining activities in the area.

In 1960, engineering projects connected with the Wabush Lake iron deposits, the Twin Falls power site and transmission line, and the building of the Northern Lands Company Railway from mile 227 on the Quebec North Shore and Labrador Railway have revealed scattered permafrost 140 miles to the south of Schefferville and the southern limit of discontinuous permafrost proposed by Brown.

The writer visited Twin Falls on Unknown River in December 1960. The falls are 108 miles east southeast from mile 287 on the Q.N.S. and L. Railway and are being developed to supply power to the Wabush Lake area. Excavations on the floor of Bonnell Canyon, a tributary of the Unknown River, showed frozen ground at 360m. (1190ft.) above sea-level. The Bonnell Canyon is a steep-sided, narrow valley trending north-south along a fault and it has a maximum relief of 100m. (300ft.). The frozen ground was discovered by engineers in early November, and its vertical extent suggests that it was not due

* Geography Department, McGill University

to seasonal frost penetration, but must be considered permafrost. The original vegetation of the valley floor was swamp and alder, with organic material forming a surface layer, .6m - 1.2m thick. On the west side of the canyon, 4.5m of glacial till was removed before frozen ground was first encountered. Both the vertical and horizontal extent of this permafrost body is unknown, but during excavation it was observed that the permafrost thickened both to the south and to the west, and at the limits of the present pit it had a vertical thickness of 8m. At this site the permafrost was identified by the development of ice lenses and wedges in bedded, varve-like deposits of silt and sand. In one 2m exposure eight horizontal ice bands were noted, varying in thickness from 1cm - 5cm.

On the east side of the exposure, two further bodies of permafrost were identified by the development of ice lenses, 5cm - 20cm thick. The two bodies widened upwards from their base 3m below the surface, and appeared to be separated by a peat basin which lensed out above the permafrost. This situation is contrary to the normal pattern of development where bog and muskeg are associated with the occurrence of permafrost. Analysis of several samples showed that the fine sands and silts within the permafrost body contained 30% - 35% water by weight. To the north and the south the sediments become coarser. They are favourable for ice-lens development and it is difficult to decide visually whether permafrost exists. However, reports on the nature of the coarser sediments during the excavation suggested that the permafrost extended to the south for a total

horizontal distance of 30m, (A. Graves, personal communication). It is anticipated that further work will locally continue down to the bedrock, 7m below the present floor of the pit, and will provide more information on the vertical extent of the permafrost. The existence of permafrost at such a low elevation probably results from the peculiar topographical conditions. The steep walls and orientation of the canyon keep the floor in continual shade, so that the annual average temperature on the canyon floor will be much lower than other areas at that elevation and latitude in Labrador-Ungava.

Engineering activities connected with the building of the Northern Lands Company Railway have resulted in reports of permafrost in the Wabush Lake area. Frozen ground was observed in 1959 during the construction of the railway (Pryer, personal communication) four miles west of mile 227. From mid-July to late September, ice lenses and ice masses, occasionally as much as 30cm in thickness, were excavated at 1 - 2m below the surface. The site lies at an elevation of 535m (1750ft) in a shallow cut (maximum depth 3m) and 500m in length. Frozen ground was reported to be virtually continuous for the whole length of the cut: it occurred under a surface layer of 60cm. organic material, and was located principally in fine sands and silt with some coarser material. Both the extent of the frozen ground and its presence in the late summer months suggest that it is permafrost.

During the construction of the transmission line from Twin Falls to Wabush Lake, frozen ground that is considered permafrost

was encountered 20 miles west southwest from mile 227 at an elevation of 545m (1790ft). The permafrost body was located on a small knoll rising out of muskeg. Excavations in early November continued down to 5.5m below the surface but failed to locate the base of the permafrost which probably extended beneath the muskeg. The reports state that ice lenses were frequent in silts and fine sands which had 34% water by weight in their frozen state. Temperature measurements taken in the ice lenses after being exposed, and with the air temperature above 0°C., gave a temperature of -1.8°C.

During the construction of the Q.N.S. and L. Railway permafrost was reported from mile 245 and 253 at 515m (1694ft) and 505m (1662ft) respectively (Woods, Pryer, Eden, 1959). At the cut at mile 245, 2.0m of material was removed below the subgrade, and it is suggested that all the permafrost was not removed even then, since to date, 1m of additional ballast has been required to compensate for annual subsidence. Within the limits of the shallow cuts, the permafrost had a horizontal extent of 32m at mile 245, and 16m at mile 253.

Exploratory drill holes have struck permafrost in the Wabush Lake iron ore bodies, though as yet no detailed report has been received.

These various reports suggest that the southern boundary of discontinuous permafrost in Labrador-Ungava must be drawn at least 140 miles south of Schefferville. All reported occurrences so far are of permafrost in frost-susceptible materials such as silts and fine sands, and it is generally found under a surface layer of organic material. In tracing the southern limit of permafrost within the pen-

insula it should be noted that the elevations at which permafrost has been reported (discounting the Bonnell Canyon location as being a special case) have averaged about 520m (1700ft) above sea level. There is thus a decided possibility that scattered bodies of permafrost exist some 300 miles south of Schefferville where the Laurentian scarp rises to 1000m (3000ft) and over.

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